Test Definition: PIPU

Pipecolic Acid, U

Overview

Useful For

Differentiating between disorders of peroxisomal biogenesis (eg, Zellweger syndrome) and disorders with loss of a single peroxisomal function

Detecting abnormal elevations of pipecolic acid in urine

Genetics Test Information

Pipecolic acid is not detected by conventional organic acid analysis of urine.

In the newborn period, pipecolic acid levels are more likely to be abnormal in urine than in plasma or serum. Abnormal levels of pipecolic acid should be interpreted together with the results of other biochemical markers of peroxisomal disorders, such as plasma C22-C26 very long-chain fatty acids, phytanic acid, pristanic acid, RBC plasmalogens, and bile acid intermediates.

Highlights

Measurement of pipecolic acid is a useful diagnostic tool for differentiating between peroxisomal biogenesis disorders (Zellweger spectrum disorders) and peroxisomal disorders caused by single enzyme deficiencies such as X-linked adrenoleukodystrophy (X-ALD).

Results must be interpreted together with the results of other biochemical markers for peroxisomal disorders.

Both urine and plasma are suitable specimens for the detection of pipecolic acid.

Testing Algorithm

See Epilepsy: Unexplained Refractory and/or Familial Testing Algorithm in Special Instruction.

Special Instructions

- Epilepsy: Unexplained Refractory and/or Familial Testing Algorithm

Method Name

GasChromatography-MassSpectrometry(GC-MS)

NY State Available

Yes

Specimen

Specimen Type

Urine

Necessary Information

Patient's age is required.

Specimen Required

Supplies: Plastic, 10-mL urine tube (T068)

Container/Tube: Plastic, 10-mL urine tube (T068)

Specimen Volume: 5 mL

Collection Instructions:

1. Collect a random urine specimen.

2. No preservative.

Forms

If not ordering electronically, complete, print, and send an Inborn Errors of Metabolism Test Request (T798) with the specimen.

Specimen Minimum Volume

2 mL

Reject Due To

All specimens will be evaluated at Mayo Clinic Laboratories for test suitability.

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Urine	Frozen (preferred)	94 days	
	Refrigerated	14 days	

Clinical and Interpretive

Clinical Information

Pipecolic acid (PA) is an intermediate of lysine metabolism and is oxidized in the peroxisomes by the enzyme L-pipecolate oxidase. In peroxisome biogenesis disorders (eg, Zellweger syndrome), the activity of this enzyme is lost, resulting in an increase in pipecolic acid levels. In contrast, in peroxisomal disorders involving single enzyme deficiencies such as D-bifunctional protein deficiency, PA is not elevated; therefore PA analysis is useful for differentiating between these 2 groups of disorders.

Increased pipecolic acid levels may also be seen in alpha-aminoadipic semialdehyde dehydrogenase deficiency (pyridoxine dependent epilepsy), hyperlysinemia types 1 and 2, and defects in proline metabolism.

Theoretically, a defect in L-pipecolate oxidase can exist and several cases of hyperpipecolic acidemia have been reported, but a specific enzyme deficiency has not been described in any of the patients.

Reference Values

< or =31 days: < or =223.8 nmol/mg creatinine

32 days-5 months: < or =123.1 nmol/mg creatinine

6 months-11 months: < or =45.0 nmol/mg creatinine

> or =1 year: < or =5.7 nmol/mg creatinine

Interpretation

Elevated pipecolic acid levels are seen in disorders of peroxisomal biogenesis; normal levels are seen in disorders with loss of a single peroxisomal function.

Abnormal levels of pipecolic acid should be interpreted together with the results of other biochemical markers of peroxisomal disorders, such as plasma C22-C26 very long-chain fatty acids, phytanic acid, pristanic acid (POX / Fatty Acid Profile, Peroxisomal [C22-C26], Serum); RBC plasmalogens; and bile acid intermediates.

Cautions

Newborns with disorders of peroxisomal biogenesis often have normal levels of pipecolic acid that increase with age.

Abnormal results may reflect either prematurity or nongenetic liver and/or renal disease.

Pipecolic acid is not detected by conventional organic acid analysis (OAU / Organic Acids Screen, Urine).

Vigabatrin interferes with pipecolic acid determination.

Methylmalonic acid interferes with pipecolic acid determination.

Clinical Reference

1. Gould SJ, Raymond GV, Valle D: Chapter 129: The peroxisome biogenesis disorders. In Scriver's Online Metabolic and Molecular Bases of Inherited Disease. Edited by D Valle, AL Beaudet, B Vogelstein, et al. New York, McGraw-Hill Education. Accessed 06/30/17. Available at www.ommbid.com

2. Wanders RJA, Barth PG, Heymans HAS: Chapter 130: Single peroxisomal enzyme deficiencies. In Scriver's Online Metabolic and Molecular Bases of Inherited Disease. Edited by D Valle, AL Beaudet, B Vogelstein, et al. New York, McGraw-Hill Education. Accessed 06/30/17. Available at www.ommbid.com

3. Peduto A, Baumgartner MR, Verhoeven NM, et al: Hyperpipecolic acidaemia: a diagnostic tool for peroxisomal disorders. Mol Genet Metab 2004;82:224-230

4. Braverman N, Raymond G, Rizzo WB, et al: Peroxisome biogenesis disorders in the Zellweger spectrum: An overview of current diagnosis, clinical manifestations, and treatment guidelines. Mol Genet Metab 2016 Mar;117(3):313-321

Performance

Method Description

Pipecolic acid is quantitated by a stable isotope dilution method; electron capture negative chemical ionization gas chromatography-mass spectrophotometry of pentafluorobenzyl esters.(Kok RM, Kaster L, de Jong AP, et al: Stable isotope dilution analysis of pipecolic acid in cerebrospinal fluid, plasma, urine and amniotic fluid using electron capture negative ion mass fragmentography. Clin Chim Acta 1987;168:143-152)

PDF Report

No

Day(s) and Time(s) Test Performed

Thursday; 8 a.m.

Analytic Time

2 days

Maximum Laboratory Time

31 days

Specimen Retention Time

1 month

Performing Laboratory Location

Rochester

Fees and Codes

Fees

- Authorized users can sign in to Test Prices for detailed fee information.
- Clients without access to Test Prices can contact Customer Service 24 hours a day, seven days a week.
- Prospective clients should contact their Regional Manager. For assistance, contact Customer Service.

Test Classification

This test was developed and its performance characteristics determined by Mayo Clinic in a manner consistent with CLIA requirements. This test has not been cleared or approved by the U.S. Food and Drug Administration.

CPT Code Information

82542

LOINC® Information

Test ID	Test Order Name	Order LOINC Value
PIPU	Pipecolic Acid, U	33659-4

Result ID	Test Result Name	Result LOINC Value
81248	Pipecolic Acid, U	33659-4
29952	Interpretation	59462-2
29954	Reviewed By	18771-6